[0043] The location of a touch relative to the touch screen **110** may be determined, for example, by processing information received from each detector **130**, **131** and performing one or more well-known triangulation calculations. By way of illustration, the computing device **201** may receive information from each detector **130**, **131** that can be used to identify the position of an area of increased or decreased energy beam intensity relative to each detector **130**, **131**. The location of the area of decreased energy beam intensity relative to each detector **130**, **131** may be determined in relation to the coordinates of one or more pixels, or virtual pixels, of the touch screen **110**. The location of the area of increased or decreased energy beam intensity relative to each detector may then be triangulated, based on the geometry between the detectors **130**, **131**, to determine the actual location of the touch relative to the touch screen **110**. Calculations to determine the interaction state indicated by the touch are explained with reference to the following figures. Any such calculations to determine touch location and/or interaction state can include algorithms to compensation for discrepancies (e.g., lens distortions, ambient conditions, damage to or impediments on the touch screen **110**, etc.), as applicable.

[0044] FIG. **3**, comprising FIG. **3**A and FIG. **3**B, illustrates a user interaction with the exemplary touch screen **110**. The user interaction in the illustrated example is intended to indicate the tracking state. A portion of the user's finger **302** (or other object) enters into the energized plane (formed by the energy beams **150**) adjacent to the touch screen surface and either "hovers" adjacent to the touch screen surface without making contact or contacts the touch screen surface with relatively slight pressure. The two detectors **130**, **131**, referred to for convenience as $Camera_0$ and $Camera_1$, generate information signals that indicate a variation in the intensity of the energized plane and, thus, the presence of a touch.

[0045] Image data captured by the detectors **130**, **131** can be processed and interpreted to approximate the interaction state indicated by the touch. For example, the output from $Camera_0$ can be processed in a known manner to determine the slopes (m_{0a} and m_{0b}) of the lines extending from a first reference point (e.g., a corner **303** of the touch screen **110**) to a first pair of outer edges **304**, **306** of the portion of the user's finger **302** that is within the field of view of the detector **130**. Similarly, the output from $Camera_1$ can be processed to determine the slopes (m_{1a} and m_{1b}) of the lines extending from a second reference point (e.g., a corner **305** of the touch screen **110**) to a second pair of outer edges **308**, **310** of the portion of the user's finger **302** that is within the field of view of the detector **131**. The choice of reference points (e.g., corners **303** and **305**) of course depends on the geometry of the detectors **130**, **131** relative to the touch screen **110**. The intersection points of the four calculated slope lines (m_{0a}, m_{0b}, m_{1a} and m_{1b}) can then be used to approximate the surface area (S) of that portion of the user's finger **302** that is within the field of view of the detector **130**, **131**. The surface area of the portion of the user's finger **302** that is within the field of view of the detector **130**, **131** (S) is referred to herein as the "touch area," though it should be understood, as mentioned above, that a "touch" does not necessarily require actual contact between the finger **302** (or other object) and the touch screen **110**.

[0046] In contrast to the tracking state example of FIG. **3**, the user interaction illustrated in FIG. **4**A and FIG. **4**B is intended to indicate the selection or "clicking" state. A portion of the user's finger **302** (or other object) enters into (or remains in) the energized plane adjacent to the touch screen surface and contacts the touch screen surface with relatively greater pressure than in the example of FIG. **3**. The two detectors **130**, **131** again generate information signals that indicate a variation in the intensity of the energized plane and, thus, the presence of a touch. In the example of FIG. **4**, the user's finger **302** may have entered the energized plane from an out-of-range position. Alternatively, the position of the user's finger within the energized plane may have changed such that it comes into contact the touch screen surface from a prior hover (non-contact) position or increases pressure on the touch screen surface.

[0047] Again, the output from $Camera_0$ can be processed in a known manner to determine the slopes (m'_{0a} and m'_{0b}) of the lines extending from a first reference point (e.g., a corner **303** of the touch screen **110**) to a first pair of outer edges **304'**, **306'** of the portion of the user's finger **302** that is within the field of view of the detector **130**. Similarly, the output from $Camera_1$ can be processed to determine the slopes (m'_{1a} and m'_{1b}) of the lines extending from a second reference point (e.g., a corner **305** of the touch screen **110**) to a second pair of outer edges **308'**, **310'** of the portion of the user's finger **302** that is within the field of view of the detector **131**. The intersection points of the four calculated slope lines (m'_{0a}, m'_{0b}, m'_{1a} and m'_{1b}) can then be used to approximate the touch area (S').

[0048] By way of comparison, FIG. **4**A shows the slope lines (m'_{0a}, m'_{0b}, m'_{1a} and m'_{1b}) and touch area (S') indicative of the selection state in solid lines and shows the slope lines (m_{0a}, m_{0b}, m_{1a} and m_{1b}) and touch area (S) indicative of the tracking state (from FIG. **3**) in broken lines. As illustrated, the touch area (S') indicative of the selection state is greater than the touch area (S) indicative of the selection state. This is so because the user's finger **302** is flexible and deforms at the point of contact (or deforms more greatly upon increase in contact pressure) to cover a larger area of the touch screen surface when the user contacts (or increases contact pressure on) the touch screen surface to make a selection.

[0049] The computing device **201** can be used to calibrate the touch screen system **100**, such that a threshold touch area is designated to represent a tracking state. Following calibration, the computing device **201** may be programmed to designate as a "selection" any detected touch having a calculated touch area exceeding the threshold touch area. As will be recognized by those of skill in the art, an exemplary calibration method involves prompting the user to perform a tracking operation with respect to the touch screen **110**, calculating the touch area while the user is doing so, and then storing that calculated touch area plus an optional error or "hysteresis" value as the threshold touch area.

[0050] In certain embodiments, the calibration step may be performed automatically when the user's finger **302** or stylus is at rest. Such a calibration method assumes that the user's finger or stylus will remain in a stationary "tracking" mode for some period of time before additional pressure is applied to indicate a "selection" operation. Other methods for calibrating the exemplary touch screen system **100** will be apparent to those of ordinary skill in the art and are therefore considered to be within the scope of the present invention.

[0051] In certain embodiments, the following exemplary trigonometric calculations can be used to approximate touch area. The equations are best understood with reference to FIG. **5**. However, it should be noted that FIG. **5** is provided as an exemplary reference only. To start:

[0052] let the cameras lie on y=0 and be 1 unit of distance apart